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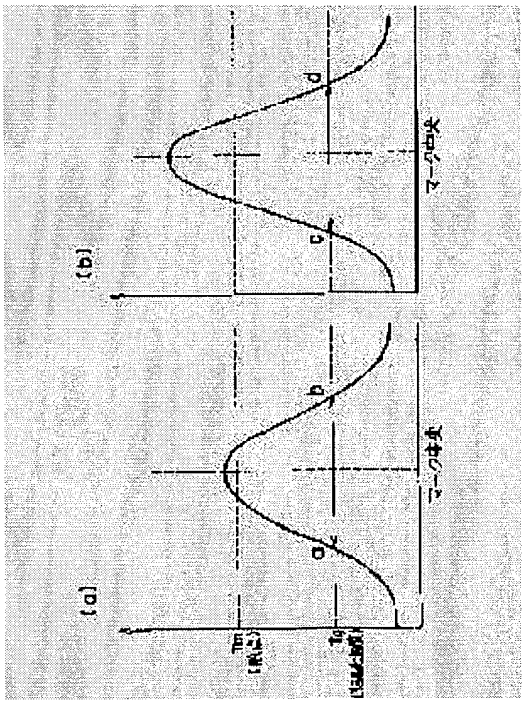
(54) OPTICAL RECORDING METHOD, FORMATTING METHOD, OPTICAL RECORDING MEDIUM AND OPTICAL RECORDER

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an optical recording method, a formatting method, an optical recording medium and an optical recorder rapidly performing recording processing, particularly a format for an overwritable phase transition type optical recording medium and reducing a time required for processing.

SOLUTION: In the optical recording method recording the data on the overwritable phase transition type optical recording medium, an initial recording linear velocity when the data are recorded on the unrecorded part of the phase transition type optical recording medium is set faster than an overwrite linear velocity when the data are overwritten. Thus, the data are recorded (formatted) at the linear velocity suited to amorphousness, and the required time is shortened.



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CLAIMS

[Claim(s)]
[Claim 1] The optical recording approach characterized by the initial record linear velocity at the time of recording data on the non-Records Department of said phase change mold optical recording medium being quicker than the over-writing linear velocity at the time of an over-write [data] in the optical recording approach which records data on the phase change mold optical recording medium [over-write / optical recording medium].
[Claim 2] Said initial record linear velocity is the optical recording approach according to claim 1 characterized by record of data being possible and being the rate which is not eliminable.
[Claim 3] The optical recording approach according to claim 1 or 2 characterized by for said over-writing linear velocity being abbreviation 1.2 m/s-5.6m/s, and said initial record linear velocity being about 7.2 or more m/s.
[Claim 4] The phase change mold optical recording medium characterized by what was recorded on claim 1 thru/or any 1 term of 3 by the optical recording approach of a publication.
[Claim 5] The format approach that it is the format approach which forms the truck for recording either [at least] address information required for record of data, elimination, or playback, or sector management information on the block which has the address of the arbitration in the phase change mold optical recording medium [over-write / optical recording medium] with a predetermined linear velocity, and said predetermined linear velocity is characterized by being quicker than the over-writing linear velocity at the time of an over-write [said phase change mold optical recording medium / data].
[Claim 6] The format approach according to claim 5 characterized by for said over-writing linear velocity being abbreviation 1.2 m/s-5.6m/s, and said predetermined linear velocity being about 7.2 or more m/s.
[Claim 7] The format approach according to claim 5 or 6 characterized by consisting of the compact disk which can rewrite said phase change mold optical recording medium, consisting of about 1 / absolute time information in every 75 seconds that eight-to-fourteen modulation of said address information was carried out, and consisting of the information which shows the attribute of the block with which said sector management information was divided every [about 1 /] 75 seconds.
[Claim 8] The phase change mold optical recording medium characterized by what was recorded on claim 5 thru/or any 1 term of 7 by the format approach of a publication.
[Claim 9] Optical recording equipment characterized by having the high-speed recording mode which is optical recording equipment which records data on the phase change mold optical recording medium [over-write / optical recording medium], and is performed with the linear velocity [over-write / which is performed with the linear velocity / over-write / linear velocity / to said phase change mold optical recording medium / linear velocity / usually as opposed to a recording mode and said phase change mold optical recording medium].

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the record processing to the phase change mold optical recording medium and this record medium about the record approach, the format approach, the optical recording medium, and optical recording equipment of an optical recording medium. [over-write / record medium / especially]
[0002]
[Description of the Prior Art] In recent years, with increase of amount of information, a lot of data are requested from record / refreshable record medium at high density and a high speed, and the optical recording medium (optical disk) is expected as a medium which can meet the above-mentioned request. There are a postscript mold which can record one-time, and a rewriting mold which any number of times can eliminate [record /] in the format of an optical disk.
[0003] As an optical disk of a rewriting mold, the optical magnetic medium using the photoelectromagnetic effect and the phase change mold optical recording medium using change of the reflection factor accompanying change of a reversible crystallized state are mentioned. A phase change mold optical recording medium has an unnecessary external magnetic field, and only by modulating the power of laser light, since record/elimination is possible, it has the advantage of leading to the miniaturization of record/regenerative apparatus. Moreover, record/elimination on the wavelength of about 800nm of the current mainstream are possible, and there is also an advantage of making possible densification by the source of short wave Nagamitsu, without changing ingredients, such as a record layer, especially. As an ingredient of the record layer in such a phase change mold optical recording medium, many chalcogen system alloy thin films are used, and the alloy of for example, a GeSbTe system, an InSbTe system, a GeSnTe system, and an AgInSbTe system can be used for this alloy film.
[0004] In current and the phase change mold record medium put in practical use, an amorphous mark is formed by making a crystallized state into un-recording / elimination condition. An amorphous mark is formed by quenching, after heating a record layer to temperature higher than the melting point. Elimination (crystallization) is higher than the crystallization temperature of a record layer, and is performed by heating a record layer to temperature lower than right above [melting point] or the melting point. It is possible to perform the above-mentioned elimination and a re-record process only by the intensity modulation of one focusing light beam in the phase change mold optical recording medium in which the so-called 1 beam over-writing is possible. Since the phase change mold optical recording medium in which 1 beam over-writing is possible can simplify the lamination of a record medium, and the circuitry of a drive, it attracts attention as a cheap and high-density mass record system.
[0005] In recent years, CD lilac ITABURU and CD-RW (Read Write) are advocated as a rewritable compact disk (CD). Although compatibility even including the high reflection factor of about 70% or more is difficult according to the CD-RW, within the limits of about 15 - 25% of reflection factors, compatibility with a compact disk is securable in respect of a record signal and a slot signal. Therefore, if the multiplier system for covering that a reflection factor is low is added to a reversion system,

compatibility is securable under the criteria of the present CD drive technique at least.
[0006]
[Problem(s) to be Solved by the Invention] By the way, in rewritable CD-RW, the record/playback approach of the information which is not in conventional CD, for example, CD recorder bull, and conventional CD-R of a postscript mold is realizable. That is, it is record of fixed-length packet data, and the random access to data, and these are performed by the hard disk and the magneto-optic disk. In order to make random access possible, address information must be beforehand recorded on the whole field which it is going to access. The minimum accessible field unit (the minimum access unit) is called a block by address information. Usually, fixed-length packet data are recorded by making a sector, and a call and a sector into a unit, 2n a bit of data being contained in 1 block, and using the block of a predetermined number as a bundle.
[0007] A block consists of data (user data) and a sub-code. A sub-code is the information about a block, address information, sector management information, etc. are included, and there are data attribute information, block attribute information, etc. in sector management information. Usually, in CD-RW, the absolute time information which makes 1 / 75 seconds the minimum access unit (block) is equivalent to address information.
[0008] Data attribute information expresses whether the user data which should be recorded is music data or it is program data, and a data attribute.
[0009] Block attribute information means distinction with the block and linking block which should record the attribute of each block in the case of forming a sector structure by two or more blocks, i.e., data. For example, in CD-RW, 2 K bytes (2014 bytes) of data are contained in 1 block. In ver1.5 of logical format UDF (Universal Disk Format) which OSTA (optical storage technology association) which is an American economic organization enacted, considering as 1 sector by making 32 blocks (64 K bytes) into a bundle is defined by CD-RW. Therefore, the sector structure which made 32 blocks 1 sector is taken.
[0010] Drawing 5 is drawing showing typically the DS in CD-RW for packet-writing. In a format of CD-RW, the sector B which consists of the user data block of 32 with which data should be recorded, and the sectors A and C before and behind Sector B are arranged, respectively, and a block is arranged as block 11 for connectors of a packet (linking block) in part. Furthermore, the run-Inn (Run-in) block 12 and the runout (Run-out) block 13 for recording additional information, such as an error correction, are attached to the sectors A and C before and behind user data (B), respectively. Thus, a format of CD-RW consists of the linking block 11, run-in block 12, a user data block (B), and run-out block 13.
[0011] Since it was recorded non-detachable as one, user data and a sub-code needed to record all over the disk including dummy data, when formatting before use of CD-RW. That is, after embedding a sub-code to data, in order to record on the whole, applying eight-to-fourteen modulation, the effect of a sub-code has attained to the whole data after record. Therefore, in order to record a sub-code, it must record also including dummy data. Moreover, unless it covers a certain amount of die length and reads data also at the time of playback, the sub-code of each block is undecipherable. It may record at a part of CD-ROM format in the form where neither sector management information nor address information is as a sub-code, and a system uses a part of user data. However, it is difficult to record only specific information like [these] the case of sub-code record, without recording the whole data.
[0012] Therefore, when formatting CD-RW, about each disk, address information and sector management information needed to be recorded all over the disk including dummy data, and the time amount for about 40 minutes was required to the disk of one sheet. The format by such complete record is called a "physical format."
[0013] In order to use CD-RW as the random based on ISO/IEC13340 and the UDFver1.5 above-mentioned specification, and the medium in which packet over-writing is possible, in addition to the above-mentioned physical format, the publication of the pointer in which the volume (Volume) management information which is the attribute of an entire disk, and the formatted recordable last address are shown, and the address of a root directory and the information on an attribute which is the entry of the beginning of this disk further are recorded, and a format is completed. In addition, whole

capacity, a corresponding operating system, etc. are indicated by the above-mentioned Volume management information.
[0014] As mentioned above, even if it performs a format of the phase change medium based on CD system format at the time of manufacture and carries out, after a user's purchasing, in order to cause the loss of great time amount, it was a big technical problem to reduce this time amount.
[0015] As mentioned above, although the concrete vocabulary was defined and the meaning of this invention was explained taking the case of CD-RW with easy explanation, this invention can be applied to all the phase change mold optical recording media [over-write / optical recording media] of DVD-RAM (Digital Versatile Disc-Random Access Memory), DVD-RW, a phase change medium, etc., and is not limited to CD-RW.
[0016] In view of the above, this invention performs the record processing to the phase change mold optical recording medium [over-write / optical recording medium], especially a format at high speed, and aims at offering the optical recording approach which can reduce the time amount which processing takes, the format approach, an optical recording medium, and optical recording equipment.
[0017]
[Means for Solving the Problem] In order to attain the above-mentioned purpose, the optical recording approach of this invention is characterized by the initial record linear velocity at the time of recording data on the non-Records Department of said phase change mold optical recording medium being quicker than the over-writing linear velocity at the time of an over-write [data] in the optical recording approach which records data on the phase change mold optical recording medium [over-write / optical recording medium].
[0018] The "linear velocity" in this invention means the Records Department of a phase change mold optical recording medium, and the relative velocity of a record light beam.
[0019] By the optical recording approach of this invention, shortening of chart lasting time is attained complete elimination ending or by recording with the linear velocity which did not have to carry out elimination (over-writing) to be crystalized and was suitable for amorphous-ization paying attention to the point only in record (amorphous-izing) when it was formatted and was the phase change mold optical recording medium of a crystallized state (format). For this reason, the record processing to a phase change mold optical recording medium, especially a format are performed at high speed, and the time amount which processing takes can be reduced sharply. Moreover, the time amount which record of data usually takes can also be shortened.
[0020] Here, record of data is possible for said initial record linear velocity, and it is desirable that it is the rate which is not eliminable. Record or a format can be performed with the linear velocity suitable for amorphous-ization by this, and shortening of chart lasting time can be attained.
[0021] Moreover, said over-writing linear velocity is about 1.2 m/s - 5.6 m/s, and it is desirable that said initial record linear velocity is about 7.2 or more m/s. In this case, the optimal linear velocity is obtained.
[0022] Since the record processing to a phase change mold optical recording medium, especially a format are performed at high speed, a manufacturing cost is reduced as compared with the conventional record medium, and the phase change mold optical recording medium recorded by said optical recording approach becomes cheap.
[0023] The format approach of the optical recording medium of this invention is the format approach which forms the truck for recording either [at least] address information required for record of data, elimination, or playback, or sector management information on the block which has the address of the arbitration in the phase change mold optical recording medium [over-write / optical recording medium] with a predetermined linear velocity, and is characterized by to be quicker than the over-writing linear velocity at the time of an over-write [said predetermined linear velocity / said phase change mold optical recording medium / data].
[0024] By the format approach of this invention, a phase change mold optical recording medium can be formatted at high speed, and the time amount which a format takes can be reduced sharply.
[0025] It is desirable that said over-writing linear velocity is about 1.2 m/s - 5.6 m/s, and said

predetermined linear velocity is about 7.2 or more m/s here. Thereby, it can be set as the optimal linear velocity.

[0026] Moreover, it is desirable to consist of the compact disk which can rewrite said phase change mold optical recording medium, to consist of about 1 / absolute time information in every 75 seconds that eight-to-fourteen modulation of said address information was carried out, and to consist of the information which shows the attribute of the block with which said sector management information was divided every [about 1 /] 75 seconds. Thereby, address information and sector management information are recordable in the optimal condition with a predetermined linear velocity.

[0027] Since the format to a phase change mold optical recording medium is performed at high speed, a manufacturing cost is reduced as compared with the conventional record medium, and the phase change mold optical recording medium recorded by said format approach becomes cheap.

[0028] The optical recording equipment of this invention is optical recording equipment which records data on the phase change mold optical recording medium [over-write / optical recording medium], and is characterized by having the high-speed recording mode performed with the linear velocity [over-write / which is performed with the linear velocity / over-write / linear velocity / to said phase change mold optical recording medium / linear velocity / usually as opposed to a recording mode and said phase change mold optical recording medium].

[0029] With the optical recording equipment of this invention, in usually changing to a recording mode with a change means in performing the usual over-writing record to an optical recording medium, and performing high-speed record or a high-speed format, it changes to a high-speed recording mode with a change means. Thereby, a phase change mold optical recording medium can be formatted at high speed, and the time amount which a format takes can be reduced sharply.

[0030]

[Embodiment of the Invention] With reference to a drawing, this invention is further explained to a detail. Drawing 1 is the explanatory view of the temperature distribution of the mark crossing direction at the time of the record in the example of 1 operation gestalt of this invention, (a) shows the slot crossing direction temperature distribution at the time of low linear velocity, and (b) shows the slot crossing direction temperature distribution at the time of high linear velocity, respectively.

[0031] After heating a record layer more than the melting point, it is necessary to make it quench by the phase change medium [over-write / medium] for formation of an amorphous mark. When a cooling rate is slow, recrystallization becomes easy to take place. Generally, a cooling rate also becomes quick, so that initial record linear velocity is quick, and a cooling rate also becomes slow, so that initial record linear velocity is slow.

[0032] It is necessary to hold a record layer for dozens to hundreds of nanoseconds to the temperature near the melting point (Tm) above the crystallization temperature (Tg) for elimination of an amorphous mark, i.e., recrystallization. When temperature is low, the crystallization itself does not take place, but even if temperature is too high, it fuses and there is a possibility of making it re-amorphous. In order to lessen the elimination remainder, it is necessary to carry out fixed time amount maintenance of the width of face of an amorphous mark at least at the above temperature. In addition, the width of face of an amorphous mark is usually about about 0.1-1-micrometer order.

[0033] Usually, since each temperature distribution of the mark cross direction which is a beam scanning direction and a direction perpendicular to a beam scanning direction become steep, respectively so that the linear velocity at the time of over-writing is quick, it is difficult to carry out fixed time amount maintenance of the whole mark width of face in the above-mentioned temperature requirement.

[0034] The straight line which connects the points a and b on the temperature-distribution change curve in drawing 1 (a), and the straight line which connects the points c and d in drawing 1 (b) show the width of face of the field by which a temperature up may be carried out beyond the crystallization temperature Tg in the mark crossing direction, respectively. Fundamentally, recrystallization occurs by each inside of the width of face between the points a and b in both drawings, and Points c and d. Therefore, without being based on linear velocity, if each width of face between a-b and c-d is the same, it can obtain the

same recrystallization, i.e., the elimination engine performance.
[0035] However, elimination becomes rather inadequate in order that the temperature of the core which is a peak may make it amorphous sharply exceeding the melting point like [at the time of the high linear velocity shown in drawing 1 (b)], when it is going to obtain the same elimination width-of-face c-d as change of the temperature distribution of the mark cross direction is steep. Or if the temperature of the center of a mark is restricted near the melting point in the steep temperature distribution in this drawing, the width of face between c-d becomes narrow, the elimination remainder will arise in a mark periphery and eliminating will become insufficient. The upper limit of the linear velocity [over-write / linear velocity] is decided by whether elimination is performed or sufficient elimination ratio can be taken. That is, it is restricted by whether comparatively flat temperature distribution are maintained, so that it crystallizes to a mark edge.
[0036] In above-mentioned CD-W, the linear velocity at the time of over-writing is usually used by 1-4X (1.2 m/s - 5.6 m/s), and an elimination ratio cannot be taken above six X (7.2 m/s - 8.4 m/s), but over-writing is difficult. However, since the whole surface is initialized and crystallized after production, in case a phase change mold optical recording medium formats in fact, it does not need to eliminate. Therefore, it is satisfactory even if it records with high linear velocity rather than the linear velocity at the time of over-writing. For example, if record of data is possible, even if it formats at the rate which is not eliminable and forms a truck, it will completely be thought that it is satisfactory.
[0037] That is, in this example of an operation gestalt, either [at least] address information required for record of data, elimination, or playback or sector management information is recorded on the block which has the address of the arbitration in a phase change mold optical recording medium with a predetermined linear velocity (format), and it is set up more quickly than the linear velocity (over-writing linear velocity) at the time of an over-write [this predetermined linear velocity (initial record linear velocity) / an optical recording medium / data]. Moreover, the linear velocity at the time of over-writing (elimination) is about 1.2 m/s - 5.6 m/s extent, and, as for the above-mentioned predetermined linear velocity, it is desirable that it is the more than rate/s which is not eliminable possible [record of data], i.e., about 7.2m.
[0038] Since the storage capacity of CD system media, such as CD-RW, is a maximum of 74 minutes, if it is completely recorded by 2X currently used for the general present, specifically, it will require about 40 minutes. However, if 6X becomes, and 8X becomes, it is completely recordable sharply with about 10 minutes in a short time for about 13 minutes. Thereby, the time amount which a complete format takes after the time of manufacture of CD-RW or a user's purchase can be shortened sharply. And a manufacturing cost is reduced compared with the conventional medium, and the optical recording medium manufactured in this way becomes cheap.
[0039] Moreover, it is desirable to consist of the compact disk which can rewrite a phase change mold optical recording medium, to consist of about 1 / absolute time information in every 75 seconds that eight-to-fourteen modulation of the address information was carried out, and to consist of the information which shows the attribute of the block with which sector management information was divided every [about 1 /] 75 seconds.
[0040] This invention does not remain only in the format approach, but when recording data only once to the non-Records Department (crystal section) of the phase change mold optical recording medium [over-write / optical recording medium], it can be applied similarly. For example, although usage like a postscript mold medium like CD-R can be carried out, a format does not perform CD-RW at this time, but the data which contain a sub-code in a non-recorded medium are recorded directly. In such a case, if this invention is applied at the time of data logging, high-speed record will be attained. In case a lot of data are recorded especially, chart lasting time can be shortened sharply and it is desirable. Or record or a format is possible similarly to the crystal section after complete elimination.
[0041] Moreover, the optical recording equipment (not shown) which records data on the optical recording medium of this example of an operation gestalt has the change means (not shown) which changes the high-speed recording mode performed with the linear velocity [over-write / which is performed with the linear velocity / over-write / linear velocity / to an optical recording medium / linear

velocity / usually as opposed to a recording mode and an optical recording medium], and both modes. When usually changing to a recording mode with a change means when performing the usual over-writing (elimination) to an optical recording medium, and performing high-speed record (high-speed format), it changes to a high-speed recording mode with a change means. The over-write [sector / predetermined / disk attribute management information or root directory information] following a format specifically.

[0042] The above-mentioned optical recording equipment is realizable by adding a high-speed recording mode or a high-speed format mode to the usual CD-RW writer. It is that the commercial CD-RW writer contains the rolling mechanism reproduced at the high speed of about 2X, the 6X or more same at the time of playback as a CD-ROM drive, and 16-32X at the time of record in most cases. Therefore, special reconstruction is not needed also when carrying out high-speed rotation of the optical recording medium, in order to obtain the high linear velocity of this invention. Moreover, a CD-R writer as well as a CD-RW writer can be used.

[0043] Since it can be regarded as one complete postscript, a complete format is recordable at a stretch, if even a rotation synchronization can be taken. Therefore, the disk ATTO WANSU mode ("CD family" Nakajima Taro Taira, **** Takao and Hiroshi Ogawa collaboration, Ohm-Sha (1996), Chapter 4) of the above-mentioned writer can use as it is, and modification of large software also has it. [unnecessary]

[0044] A rotation synchronization can be attained more to accuracy by making it synchronize with slot meandering (wobble) of the constant frequency which could attain by autonomous control of the spindle which carried the disk, or was beforehand formed in the disk ("CD family" Nakajima Taro Taira, **** Takao and Hiroshi Ogawa collaboration, Ohm-Sha (1996), Chapter 4). Moreover, not only slot meandering but a flute width and a channel depth may be modulated periodically.

[0045] Drawing 2 (a) and (b) are drawings showing the record pulse strategy at the time of low linear velocity over-writing of CD-RW, respectively. In order to apply this invention to a phase change mold optical recording medium, consideration is required for the modulation of the record power at the time of mark length record. In order an over-write [optical recording medium / phase change mold], between marks, the elimination power Pe which may recrystallize an amorphous mark is irradiated, and in case the mark equivalent to nT (the integer of n=3-11 and T are a reference clock period) shown in drawing 2 (a) is formed, many things recorded as follows are also performed.

[0046] Namely, when referred to as m=n -1, alpha1=0.1-1.5, alphai=0.1-0.6 (2 <=i<=m), and betai=0.4-0.9 (1 <=i<=m), nT is divided like alpha1T, beta1T, alpha2T, beta2T, ..., alphamT, and betamT. The record power Pw (> Pe) which is sufficient for carrying out melting of the record layer to time amount alphaiT (1 <=i<=m) is irradiated, and the bias power Pb which becomes 0<Pb<=0.5Pe is irradiated at time amount betaiT (1 <=i<=m). However, it can be set to 0<Pb<=Pe or 0 <=betam<0.5 in betamT.

[0047] In CD-RW, as n-1 record pulse is divided and irradiated and the beam which has the record power Pw at the time of record of nT mark is usually shown in drawing 2 (b), the 1st record pulse alpha 1 is set to 1.0T, and all of consecutive record pulse alphai and betai are set to 0.5T.

[0048] Even if it establishes the off pulse period which divides a record pulse and irradiates bias power, melting of the record layer is fully carried out, and it can form continuous nT mark. In recording like CD-RW with the low linear velocity of 1-4X of CD linear velocity, in order to prevent a cooling rate becoming slow and to promote stable formation of an amorphous mark especially, the division of timer pulse period and an off-pulse are desirable. In addition, an over-write [it / the amorphous mark recorded in write-once one with high linear velocity records by the above pulse strategies with eliminable low linear velocity, and].

[0049] In the case of the write-once record with the high linear velocity of this invention, or a format, the above division of timer pulse period is not necessarily needed. Since the cooling rate of a record layer also becomes quick in high linear velocity, the necessity which dares prepare the off pulse section, raises the cooling rate of a record layer, and promotes amorphous mark formation is small. Moreover, since elimination is unnecessary, it is not necessary to irradiate elimination power between record marks. It is also possible to record with binary [of record power and playback power].

[0050] Rather, since a clock frequency also becomes high in high linear velocity, it is necessary to carry

out improvement in the speed of a pulse dividing network, and the high-speed modulation of laser. If it is a circuit reproducible by 16X as a circuit, the clock of 0.5T is generable also by 8X record. However, since the high-speed modulation of the laser diode for record is a still advanced technique, the approach which does not use the record division of timer pulse period in high frequency is also used.

[0051] Drawing 3 is drawing showing an example of the record pulse strategy at the time of high linear velocity record, in (a), a signal wave form and (b) show a record power wave, and (c) shows another record power wave, respectively. In order to form nT mark shown in drawing 3 (a), it is desirable to impress the square wave of the pulse duration who shows drawing 3 (b) which subtracted the pulse duration of tauT from the pulse duration of nT. Here, tau is the amendment time amount for amending the mark length at the time of record so that nT mark may be correctly read at the time of playback. tauT is good also as a time delay of the head of nT signal, and good also as abbreviated time of the back end. As for the amendment time amount tau, for more exact mark length control, it is desirable to be referred to as function [for every mark length] tau (n).

[0052] Moreover, it is also desirable to change record power gradually as record power which is different in a part of head of the record pulse shape of nT-tau T as shown in drawing 3 (c) when amending the balance of the die length of a long mark and a short mark especially. Such a record pulse control system is not yet applied to CD-RW.

[0053] Pw in drawing 3 (b) and (c) is record power, and is power which is sufficient for carrying out the temperature up of the record layer more than the melting point, and forming an amorphous mark. The bias power Pb is chosen so that it may be about set to 0<Pb/Pw<0.5. Moreover, in drawing 3 (b) and (c), it is also possible by making Pb of mark termination lower than Pb of the section of 0.5T-1T, and other sections to prepare the configuration of mark termination.

[0054] Among the phase change mold optical recording media [over-write / optical recording media], formation of the address information by the pre pit or sector management information is difficult for this invention, and it is aimed at shortening sharply the format time amount of the medium by which a drive or formatting with a writer becomes indispensable. This invention is widely applicable to the phase change medium called DVD (Digital Versatile Disc or Digital Video Disc) in which rewriting besides CD-RW is possible.

[0055] Next, the structure of the phase change medium used for this invention is explained. Although especially the substrate of the phase change medium of this invention is not limited, transparence resin, such as a polycarbonate, an acrylic, and polyolefine, or clear glass can be used, for example. Especially, polycarbonate resin also has the track record most widely used with CD, and since it is also cheap, it is the most desirable. Moreover, as for a phase change mold record layer, it is desirable to cover the upper and lower sides with the protective layer.

[0056] Furthermore, it is desirable to have a substrate / lower protective layer / record layer / up protective layer / reflecting layer in this order, to cover the top face of a reflecting layer with ultraviolet-rays hardenability or thermosetting resin, and to form the protection coat.

[0057] although the chalcogen system record layer mentioned above is generally used as a phase change record layer -- especially -- crystal/-- amorphous -- the m/sbTe alloy thin film with which any condition uses as a principal component the SbTe alloy near the Sb70Te30 eutectic point in which the phase transition of stability and the high speed between each conditions of both is possible is desirable. M is at least one sort in In, Ga, Zn, germanium, Sn, Si, Cu, Au, Ag, Pd, Pt, Pb, Cr, Co, O, S, Se, Ta, Nb, and V.

[0058] A linear velocity dependency is influenced by the Sb/Te ratio on the basis of a Sb70Te30 eutectic-point presentation in [the above-mentioned record layer] 1st order. Therefore, as for a presentation, Mww(SbzTe1-z)1-w is used suitably. Here, it is at least one sort in 0<=w<=0.2, 0.6<=z<=0.8, M=In, and Ga, Zn, germanium, Sn, Si, Cu, Au, Ag, Pd, Pt, Pb, Cr, Co, O, S, Se, Ta, Nb and V.

[0059] Generally the thickness of a phase change mold record layer has the desirable range of 10nm - about 30nm. If thickness is thinner than 10nm, sufficient contrast will be difficult to get, and there will be an inclination for a crystallization rate to become slow, and record elimination in a short time will tend to become difficult. On the other hand, if the thickness of a phase change mold record layer is

thicker than 30nm, since it is hard coming to obtain too optical contrast and becomes easy to produce a crack, it is not desirable. Moreover, if thicker than 30nm, heat capacity will become large and good record sensibility will be spoiled.
[0060] In order to prevent deformation by the elevated temperature at the time of record, it is desirable to prepare a lower protective layer in a substrate front face, and to prepare an up protective layer on a record layer, respectively. As an ingredient of a protective layer, it is determined with careful attention to a refractive index, thermal conductivity, chemical stability, a mechanical strength, adhesion, etc. Generally, fluorides whose transparency is high-melting highly, such as an oxide of a metal or a semi-conductor, a sulfide, a nitride, and calcium, Mg, Li, can be used. As for these oxides, a sulfide, a nitride, and a fluoride, it is also effective for it not to be necessary to necessarily take stoichiometric composition, and to control a presentation for control, such as a refractive index, or to mix, and to use.
[0061] Dielectric mixture is suitable if a repetition recording characteristic is taken into consideration. More specifically, the mixture of ZnS or a rare earth sulfide, and heat-resistant compounds, such as an oxide, a nitride, and carbide, is mentioned. As for the film consistency of these protective layers, it is desirable from the field of a mechanical strength that it is 80% or more of a bulk condition. In using a mixture dielectric thin film, it uses the theoretical density of a degree type (1) as a bulk consistency.
Rho=sigma mirhoi .... (1)
(However, mol concentration of mi:each component i, rhoi: Independent bulk consistency)
[0062] In order to control the substrate deformation by the heat damage at the time of repetition over-writing, a certain amount of lower protection layer membrane thickness is required. If lower protection layer membrane thickness is set to less than 70nm, repetition over-writing endurance will fall rapidly. A repeat count depends especially for the fall of the jitter in early stages of less than hundreds of times on lower protection layer membrane thickness remarkably.
[0063] By observation by atomic force microscopes (AFM), such as this invention person, it was checked that this initial degradation is what is depended on the deformation in which about about 2-3nm of substrate front faces becomes depressed. In order to control substrate deformation, the heat insulation effectiveness for not telling generation of heat of a record layer is required for the need and protection layer membrane thickness which holds down deformation mechanically. In order to attain at least 1000 times of the endurance needed for this kind of medium, about 70nm or more of thickness about 80nm or more is required preferably.
[0064] An up protective layer prevents the counter diffusion of a record layer and a reflecting layer. Moreover, if an up protective layer is thinner than 10nm, it is not [that the deformation at the time of record layer melting etc. is easy to be destroyed] desirable, and the heat dissipation effectiveness is too large and it is not desirable at the point that the power which record takes becomes large superfluously.
[0065] A record layer, a protective layer, and a reflecting layer are formed by the sputtering method etc. The target for record film, the target for protective coats, and when required, it is desirable to perform film formation with the in-line equipment which installed the target for reflecting layer ingredients in the same vacuum chamber at the point of preventing the oxidation and contamination between each class.
[0066]
[Example] 6X write-once mode record was performed to the CD-RW medium for commercial 2X record (Mitsubishi Chemical, Inc., RW 650U1). DDU1000 (nm [780], NA=0.55) made from a pulse tech was used for record. First, these media were hardly able to eliminate in 6X. This medium follows and is not used by 2X. moreover -- since additional information record of the file management information for a format etc. takes about further 10 minutes for about 40 minutes at complete record in 2X -- a total -- about 50 minutes is needed. Here, only 1 time recorded on the intact disk by the same record pulse strategy as drawing 2 at 6X by the EFM random pattern which is the modulation technique of CD. Playback was performed in 1X according to specification.
[0067] Drawing 4 is a graph which shows the power dependency of 3T jitter at the time of the 1-time record in 6X, and showed the power dependency of the jitter between 3T marks which are the severest shortest mark in signal quality all over drawing. As shown in this drawing, in this example, the jitter for less than 35ns (it must be less than 35ns on specification) was obtained by 14mW or more, and the

asymmetric good eye pattern which is not almost was obtained.
[0068] If an EFM random pattern can record good and what kind of contents it will be, the information record in a format is possible. For example, complete record and file management information record can be completed in about 15 minutes at the time of 2X record which is the time amount of 3 about 1/.
[0069] As mentioned above, although this invention was explained based on the suitable example of an operation gestalt, the optical recording approach, the format approach, the optical recording medium, and optical recording equipment of this invention are not limited only to the above-mentioned example of an operation gestalt, and an example, and the optical recording approach and the format approach of having performed various corrections and modification from the above-mentioned example of an operation gestalt and the example, an optical recording medium, and optical recording equipment are also contained in the range of this invention.
[0070]
[Effect of the Invention] As explained above, according to the optical recording approach, the format approach, the optical recording medium, and optical recording equipment of this invention, the record processing to the phase change mold optical recording medium [over-write / optical recording medium], especially a format can be performed at high speed, and the time amount which processing takes can be reduced.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the explanatory view of the temperature distribution of the mark crossing direction at the time of the record in the example of 1 operation gestalt of this invention, and (a) shows the slot crossing direction temperature distribution at the time of low linear velocity, and (b) shows the slot crossing direction temperature distribution at the time of high linear velocity, respectively.
[Drawing 2] It is drawing showing the record pulse strategy at the time of low linear velocity over-writing of CD-RW in this example of an operation gestalt.
[Drawing 3] It is drawing showing an example of the record pulse strategy at the time of the high linear velocity record in this example of an operation gestalt, and (a) shows a signal wave form and (b) record power wave, and (c) shows a record power wave, respectively.
[Drawing 4] It is the graph which shows the power dependency of 3T jitter at the time of the 1-time record in 6X.
[Drawing 5] It is drawing showing typically the DS in CD-RW for packet-writing.
[Description of Notations]
Tg: Crystallization temperature
Tm: Melting point
Pb: Bias power
Pe: Elimination power
Pw: Record power
alpha 1, alphai, betai: Record pulse

[Translation done.]

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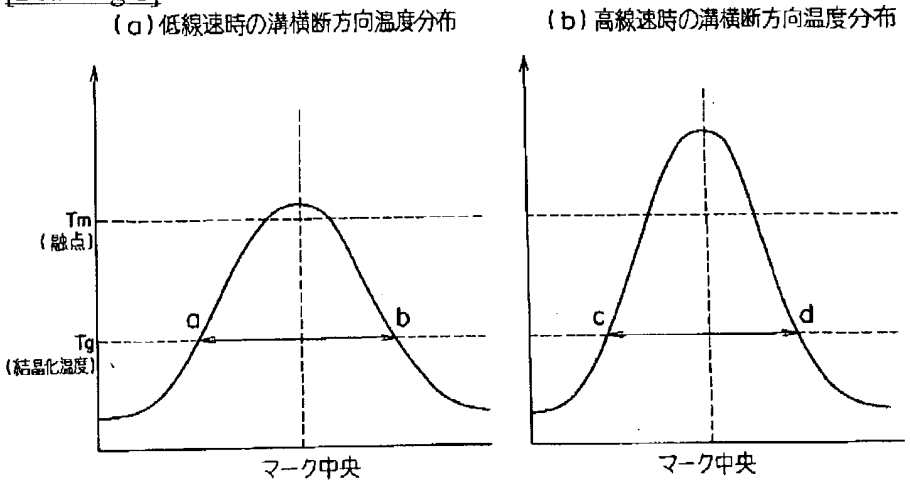
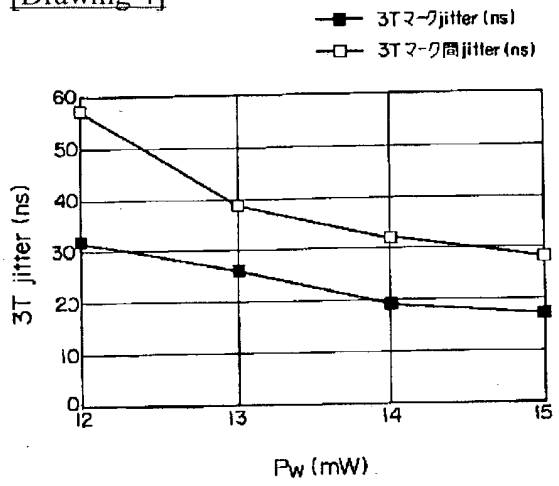
DRAWINGS

[Drawing 1]

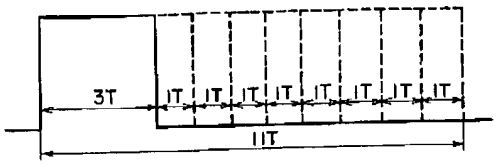


[Drawing 4]

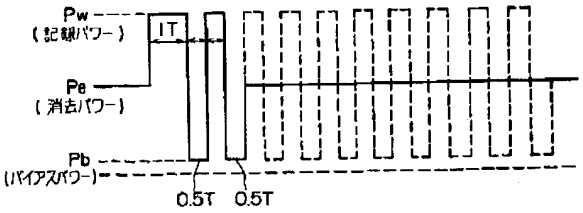


[Drawing 2]

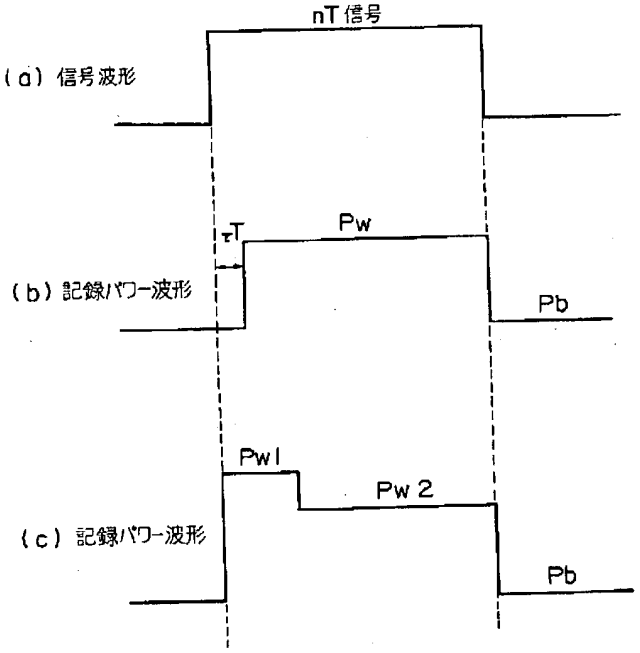
(a)



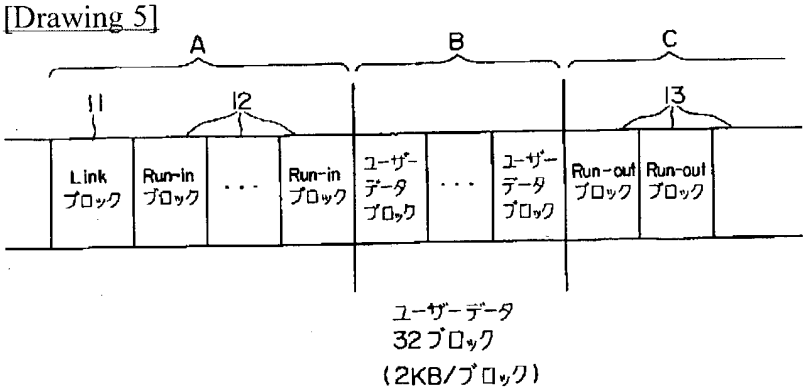
(b)



[Drawing 3]



[Drawing 5]



[Translation done.]